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PAR 210

FINAL REPORT

Lamination of Glass Slides

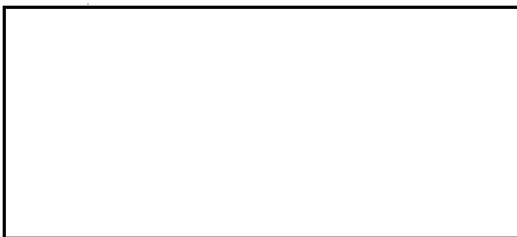
24 July 1964

Prepared by:

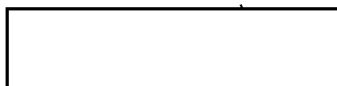


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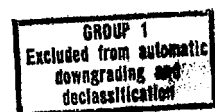
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SUMMARY

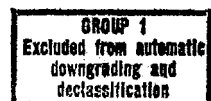
A special fixture was built and a technique was established for mounting film to glass plates. This was part of an effort to prevent film buckling which occurred when slides were projected for extended periods in a 3000-watt Tele Pro 6000 projector.

Concurrently, a Tele Pro 6000 projector was modified to provide adequate cooling for the laminated slides. A 125 cfm auxiliary blower was added to the projector front to decrease slide temperature from 240 to 120 F during projection.

As a result of the above efforts, laminated slides were successfully projected in the modified Tele Pro 6000 for periods up to five hours without film buckling.

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SUBJECT: Lamination of Glass Slides

#### TASK/PROBLEM

1. Develop an inexpensive piece of equipment and/or technique to laminate or mount film to prevent buckling when film is used with a Tele Prompter projector.

#### INTRODUCTION

2. Direct bonding of film to glass is recognized as the best method for preventing buckling during extended projection. Also, over-all results are improved as the slide temperature is reduced.

#### DISCUSSION

##### 3. Slide Lamination Technique:

a. Fixture: To achieve successful lamination, a special fixture was built which consists of an illuminated viewer with a ground glass top to aid in positioning the film on an acetate sheet, a roller mounted on fixed slide rails, and a flat platen with a square for locating the glass slide plate. Only film 3 1/4 x 4 inches can be mounted onto identical size glass plates in this fixture. The fixture with identification of its major components is shown in Figure 1.

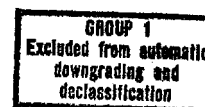
##### b. Film Preparation:

(1) Better laminating will be accomplished if the film is completely dry and if all materials (film, glass, cement, and the mounting fixture) are at a temperature of 80 F. Also, if possible, the work room should be fairly warm (75 to 80 F).

(2) Films that were processed with a hardening fix are more subject to bubble formation during cementing than films processed without hardener. Hardened black-and-white film gelatins should be softened by immersing in a 42 percent solution of sodium carbonate for two to five

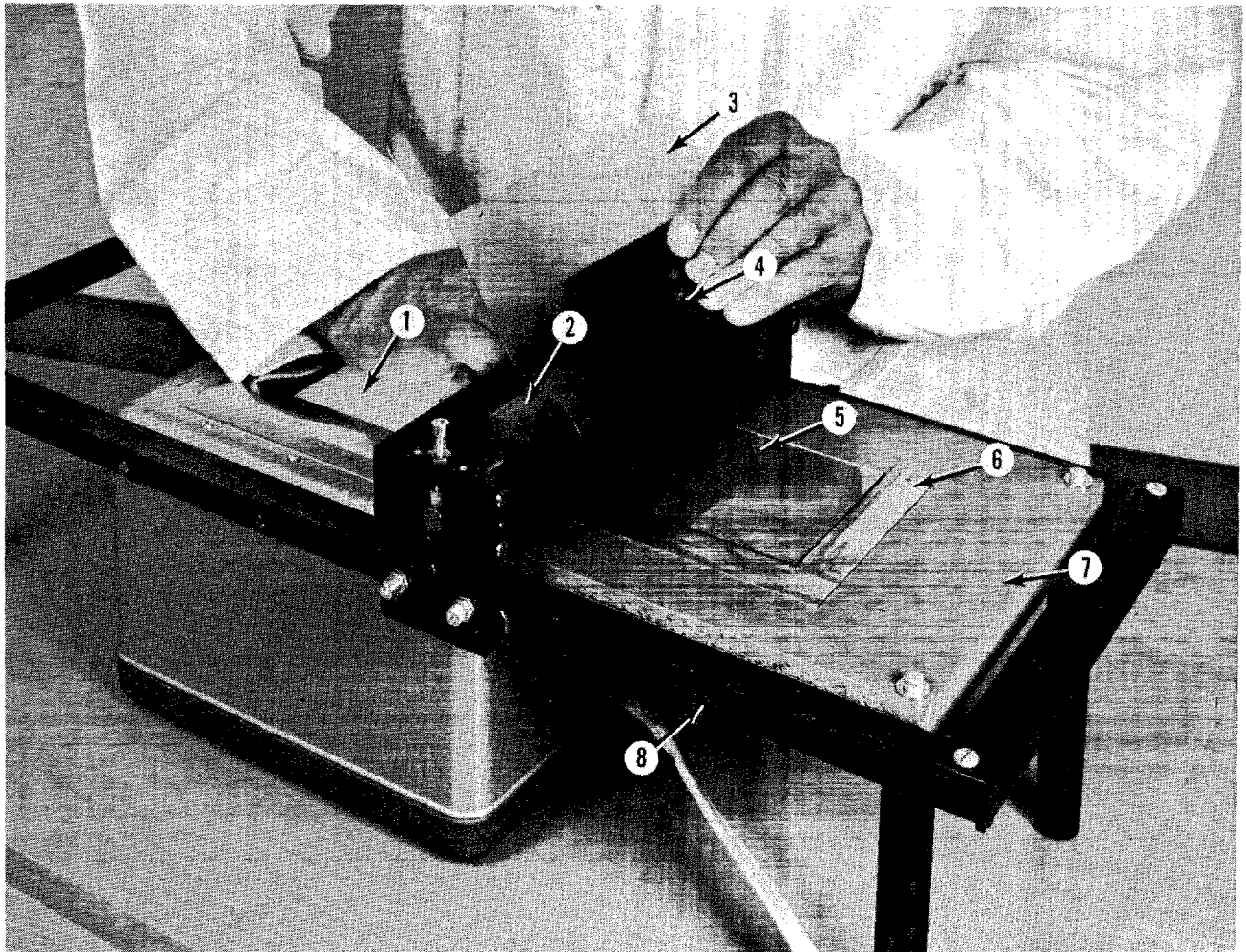
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1. Ground glass top
2. Roller
3. Acetate sheet
4. Film

5. Glass plate
6. Square
7. Platen
8. Slide rails

Figure 1. Slide Laminating Fixture

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minutes; followed by a rinse in running water. Before mounting, these films should be completely dry.

(3) Ektacolor and Kodachrome films have a laquer layer on the emulsion side. This layer must be removed by following either method listed below:

(a) Method 1:

(1) Dissolve one level tablespoon of sodium bicarbonate (baking soda) in one pint of water (not above 75 F). Soak transparency for one minute.

(2) Rinse for one minute in running water at 60 to 70 F, preferable about 65 F.

(3) Bathe in ☐ Photo-Flo solution or wipe carefully with damp viscose sponge and hang to dry in dust-free location.

(b) Method 2: Wipe film with absorbent cotton saturated in a mixture containing one tablespoon of household ammonia to one cup of denatured alcohol. Wipe emulsion side only, with film base on a smooth surface (glass) to avoid scratching base. (This method has the advantage of drying quickly, but it requires more care to prevent film scratching.)

(4) At present, Ektachrome film does not have the laquer layer and can be cemented without pretreatment.

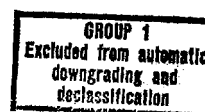
c. Mounting Procedures:

(1) Precoated Plates

(a) Flooding with Solution (Preferred)

(1) This method uses plates precoated with gelatin.

The glass plate is placed on an absorbent surface such as a cellulose sponge and flooded with a 40 to 50 percent alcohol and water mixture from a squirt bottle. The excess liquid is drained off, and the gelatin plate is allowed to soften about 30 seconds before it is placed on the platen. The film, located on the acetate sheet, is held in a vertical position for the rolling operation.

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The roller should traverse the acetate-film sheet in an even motion requiring about two seconds for the four inches of film. The film and glass are then removed from the platen, and the excess liquid is wiped off with a clean damp sponge or cloth. The platen, acetate sheet, and roller are also wiped clean and dry.

(2) The slide is placed base side down on a warm (up to 90 F ) flat surface to dry. A weight can be placed on top of the glass if desired. After drying, the film is trimmed, and the laminated slide is ~~re~~washed if necessary. After one hour, slides so mounted can be projected at 120 F, but microscopic bubbles may form. After 24 hours, the laminated slide is fully set and can be projected at 120 F for indefinite periods without bubble or vapor formation. Slides may also be projected at 240 F but there is a chance of damaging the lamination if they are projected for extended periods.

(b) Vaporizing

This technique appeared promising since it is fast, clean, and allows immediate projection without harming the laminated slide. However, when tried, the method invariably produced a myriad of tiny bubbles between the film and glass plate that degraded the projected image.

(2) Uncoated Plates

(a) In this method, a plain glass plate free from dirt, grease, or fingerprints is positioned on the flat platen. Then, the film is prepared (remove laquer if necessary) and placed with one 3 1/4-inch edge over double-sided adhesive tape in position on the rolling sheet of acetate. With an all-rubber syringe, a bead of cement (see formula in Appendix A) is placed on the leading edge of the glass in such a manner as to be free of air bubbles. The roller passes over the film and spreads the cement evenly between the film and glass. Excess cement is used to insure

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complete coverage. As in the previous method, film, plate, and rolling fixture are wiped clean and dry after each cycle.

(b) Slide drying and handling are the same as for the flooding method.

Note: Air bubbles formed when applying the alcohol and water mixture or in the applied bead of cement will be trapped between film and glass during rolling operation and will be noticeable during projection.

4. Test Projector: Since this study was initiated chiefly because of a need for a non-buckling slide that could be projected for extended periods in a Tele Pro 6000 projector, a projector was acquired for tests to help determine the best laminating technique. It was soon discovered that the slide temperature reached 240 F in the unmodified projector because the incorporated blower does not have sufficient air output to cool the slide properly.

a. Description: The projector used in the tests is a Tele Pro 6000 manufactured by [REDACTED] The projector operates on 110 volts, ac, and is equipped with an internal blower for cooling the [REDACTED] projection lamp, rated at 3000 watts. The lens, made by [REDACTED] is a 5-inch, f/1.0 Cinema Raptor Projection with a wide angle of nearly 30 degrees.

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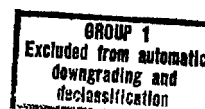
b. Modifications:

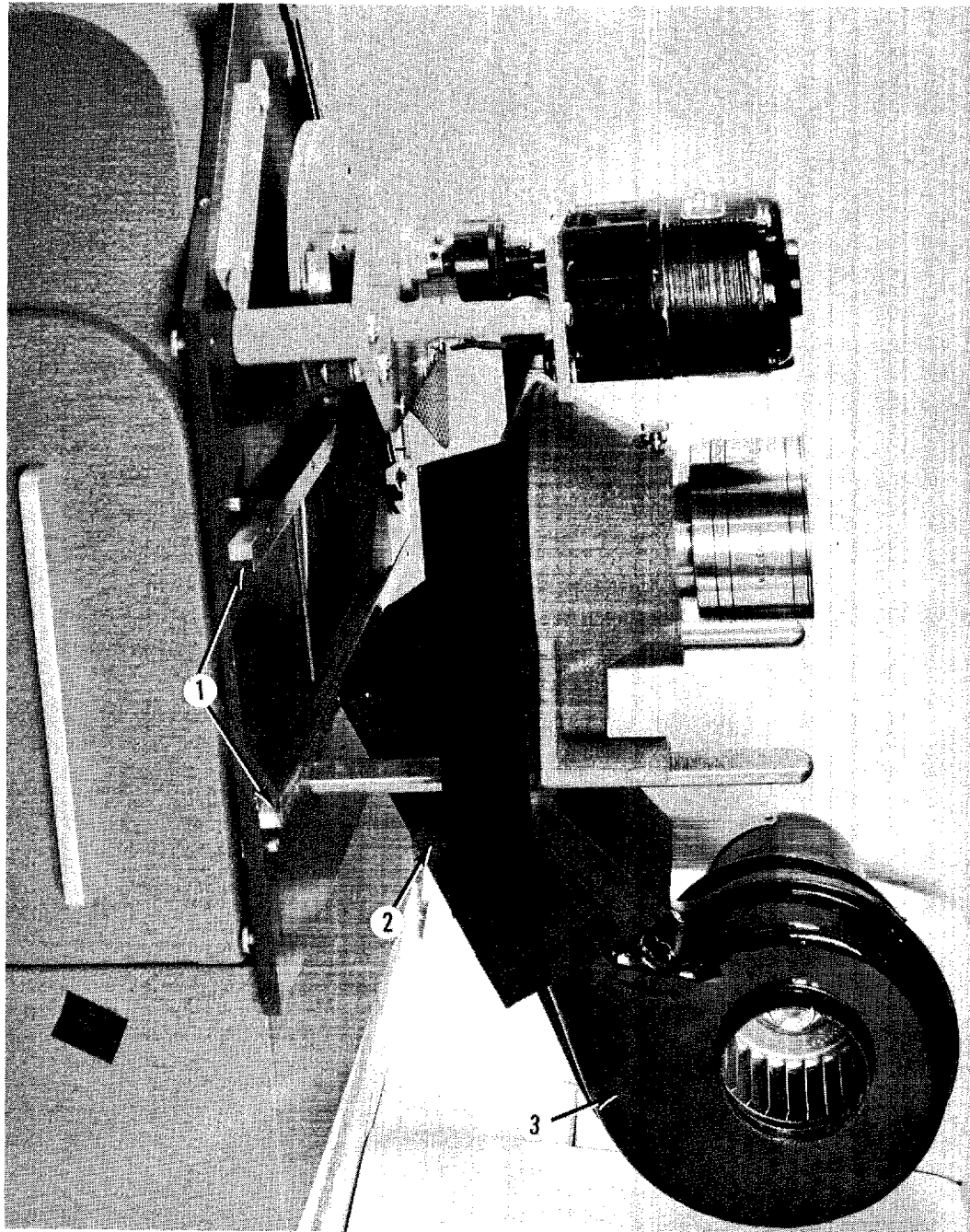
(1) An auxiliary blower with an output of approximately 125 cfm was added to the outside front of the projector with the air stream directed on the screen side of the slide. See Figure 2. This addition and minor internal adjustments lowered the slide temperature to approximately 120 F.

(2) To demonstrate that a slide temperature of 120 F can be maintained, Type 7302 film was exposed to a blank flash density of two, mounted, and placed in the projector. At this density, nearly zero light

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1. Slide bracket
2. Duct
3. Auxiliary blower

Figure 2. Auxiliary Blower in Front of Projector

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came through and the slide reached its maximum temperature. However, with the additional air flow over the front surface of the slide, no harmful increase of temperature was noted. Figure 2 shows the auxiliary blower mounting and the air duct. This mounting does not interfere with projector operation nor does it increase the vibration on the slide or projection lens.

(3) Although an attempt was made to increase the air output of the projector's internal blower, it was discovered that as blower output was increased, vibration increased to a point that affected the projected image.

#### CONCLUSIONS

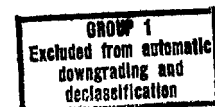
8. Film slides can be projected for indefinite periods when:
  - a. Properly laminated to glass plates and allowed to dry for 24 hours.
  - b. Projected in a projector that has been modified to provide sufficient cooling.
9. The Tele Pro 6000 projector operates satisfactorily when properly equipped with an auxiliary blower.

#### RECOMMENDATIONS

10. That slides to be projected by the Tele Pro 6000 projector be mounted according to the described methods (see paragraph 3c).
11. That for prolonged satisfactory operation, the Tele Pro 6000 projector be modified by adding the external blower (see paragraph 4b).

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APPENDIX A  
CEMENT FORMULA

1. 10 grams pure gelatin (Knox, edible)
2. 85 cc boiled, warm water - stir in gelatin until it dissolves
3. 2 cc denatured anhydrous alcohol
4. 1 cc ammonium hydroxide, 28 percent
5. 1/10 cc Photo-Flo or equivalent
6. 1 drop mold-inhibiting agent (Mercurochrome)

While warm, stir and mix thoroughly; next filter through coarse filter paper and bottle for use. Cement will be jellied when cold and can be warmed before use. Cement will keep several days at room temperature and for much longer periods in the refrigerator; however, do not freeze. A good applicator is a small all-rubber "ear" syringe.

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